



# REAC/TS

Radiation Emergency  
Assistance Center/Training Site

<https://orise.orau.gov/reacts>

## REAC/TS Fact Sheet for Medical Providers

### Fast Facts:

**Exposed only:** Individuals exposed to a discrete, intact radioactive source have radiation exposure, not contamination. They present no risk to treating medical personnel.

**Contaminated:** Radioactive contamination on bodies or clothing (external contamination) or have inhaled/ingested/absorbed (internal) radioactive contamination are at continued risk of worsening radiation injury and after life-saving treatment, should be decontaminated and / or treated for internal contamination. Risk may be mitigated to care-giver and patient.

**Radiation Combined Injury:** Trauma and / or burns in addition to radiation injury. These patients will increase 1-2 triage acuity categories and will have a worse prognosis.

**Mitigating Risk:** Rapid removal of casualties from blast site, getting out of the area around the blast site, treating in a solid shelter, when possible, and use of personal protective equipment as appropriate to the hazard or hazards.

### Ionizing Radiation Injury:

Ionizing radiation induced biological effects are determined by:

- Dose, Dose rate, Volume of body part exposed, Radiation type, Co-existing health conditions, Trauma, Burns
- Main site of cellular injury: DNA (immature/rapidly dividing cells at high risk)

### Acute Radiation Syndrome:

**TREAT LIFE-THREATENING CONDITIONS FIRST!**

The lethal dose (LD) that kills 50% of the exposed population (LD50) within 60 days after exposure (LD50/60) is:

Dose leading to sub-syndromes:	
Subclinical	0-1 Gy
Hematopoietic	≥1-2 Gy
Gastrointestinal	5 - 6 Gy
Neurovascular	10 Gy
Cutaneous	6 Gy

Healthy, young adults without therapy: ~3.5 – 4.0 Gy

Shifts to right with adults with antibiotics, supportive care and colony stimulating growth factors

### Sub-syndromes:

**Hematopoietic (bone marrow) syndrome:** Loss of lymphocytes followed by neutrophils, and later, loss of red blood cells (RBCs) and platelets

Immune dysfunction, infections and sepsis, impaired wound healing, and hemorrhage may also occur

**Treatment:** Neutropenic precautions, consider prophylactic fluoroquinolones and/or other antimicrobials

U.S. FDA approved treatments:

G-CSF, PEGylated G-CSF, GM-CSF:

- Filgrastim: 10 mcg/kg, subcutaneous q day
- PEGfilgrastim: 2 doses, 6 mg each given 1 week apart
  - Pediatric: < 10 kg: 0.1 mg/kg; 10-20 kg: 1.5 mg; 21-30 kg: 2.5 mg;
  - 30-45 kg: 4 mg
- Sargramostim (GM-CSF):
  - Adults and Pediatric patients > 40 kg: 7mcg/kg
  - Pediatric patients 15 kg to 40 kg: 10 mcg/kg

Romiplostim: Thrombopoietin receptor agonist for thrombocytopenia:  
[nplate\\_pi\\_hcp\\_english.pdf \(amgen.com\)](http://nplate_pi_hcp_english.pdf(amgen.com))

**REAC/TS**  
Radiation Emergency  
Assistance Center/Training Site

### Putting on Protective Clothing (Donning)

- 1 Shoe Covers.
- 2 Coveralls or Isolation Gown: At minimum, fully cover torso from neck to knees, arms to ends of wrists. Fasten or secure appropriately.
- 3 First set of gloves underneath cuff of coveralls or gown.
- 4 Tape sleeves and trouser cuffs (as applicable). Tape any other potential areas of contaminant entry, such as an uncovered zipper.
- 5 Face Mask: Secure ties or elastic band. Fit flexible band to bridge of nose and secure below chin.
- 6 Head Covering.
- 7 Face Shield or Goggles.
- 8 Second set of gloves. Extend to cover wrist of coveralls or isolation gown.
- 9 Identifying Information: Name and role on front and back of protective wear.
- 10 Dosimeter (if available).

Dr. Smith  
Emergency Department

OAK RIDGE INSTITUTE  
FOR SCIENCE AND EDUCATION  
Shaping the Future of Science



**REAC/TS RADMED App**  
Search RADMED on Android or Apple



**Gastrointestinal (GI) syndrome:** May present with nausea, vomiting, diarrhea, bloody stool, and dehydration

GI bleed, bowel obstruction, acute renal failure, cardiovascular failure (8 - 14 days) may occur

**Treatment:** Antiemetics as indicated, enteral/parenteral nutrition, intensive care, consider bowel decontamination, stress ulcer prophylaxis

**Neurovascular syndrome:** Nausea and vomiting within 30 minutes, confusion and disorientation within minutes, severe hypotension, and fluid shifts, with possible cerebral edema, ataxia, seizures, coma

May be fatal within 24 – 48 hours

**Treatment:** Supportive and if resource adequate, intensive care

**Triage/Dose Estimation: TREAT LIFE THREATENING CONDITIONS FIRST!**

History and physical; time to vomiting; geographic location and time in area of blast; clinical prodrome from above; Complete Blood Count (CBC) with differential every 6-12 hours; and dicentric chromosome analysis (will take minimum 4 days)

**Biodosimetry Based on Acute Photon-Equivalent Exposures**

Dose [Gy]	Onset of vomiting		Lymphocyte count (x10 <sup>9</sup> /liter) by day*						Lymphocyte depletion rate	Number of dicentrics	
	%	Time [hr]	0.5	1	2	4	6	8	Rate constant	Per 50 cells	Per 1000 cells
0	--	--	2.45	2.45	2.45	2.45	2.45	2.45	--	0.05 - 0.1	1 - 2
1	19		2.30	2.16	1.90	1.48	1.15	0.89	0.126	4	88
2	35	4.63	2.16	1.90	1.48	0.89	0.54	0.33	0.252	12	234
3	54	2.62	2.03	1.68	1.15	0.54	0.25	0.12	0.378	22	439
4	72	1.74	1.90	1.48	0.89	0.33	0.12	.044	0.504	35	703
5	86	1.27	1.79	1.31	0.69	0.20	0.06	.020	0.63	51	1024
6	94	0.99	1.68	1.15	0.54	0.12	0.03	.006	0.756		
7	98	0.79	1.58	1.01	0.42	.072	.012	.002	0.881		
8	99	0.66	1.48	0.89	0.33	.044	.006	<.001	1.01		
9	100	0.56	1.39	0.79	0.25	.030	.003	<.001	1.13		
10	100	0.48	1.31	0.70	0.20	.020	.001	<.001	1.26		

\* The normal range for lymphocytes in human blood is between 1.4 and 3.5 x 10<sup>9</sup> per liter. Lymphocyte depletion rate is based on the model  $L_t = 2.45 \times 10^9 / \text{liter} \times e^{-kt}$  where  $L_t$  equals the lymphocyte count (x10<sup>9</sup>/liter), 2.45 x 10<sup>9</sup>/liter equals the a constant representing the consensus mean lymphocyte count in the general population, k equals the lymphocyte depletion rate constant for a specific acute photon dose, and t equals the time after exposure (days)

Wasalenko JK et al. Ann Intern Med, 2004

**Cutaneous Radiation Injury/Syndrome:**

- Acute effects (days to weeks post exposure): Redness, swelling, blisters, ulceration, tissue necrosis
- Long-term issues (month to years post exposure): Fibrosis, atrophy (sclerosis), and telangiectasia formation

**Treatment:** Topical Class II/III steroids, antihistamines, antibiotics, and moisturizers (Aquaphor®), Pentoxifylline with α-tocopherol; growth factors; artificial skin/bioengineered constructs; debridement; and other surgical techniques

Dose [Gy]	Sign	Timing
3	Epilation	Begins around day 14 - 17
6	Erythema Distinguish from thermal burn	Minutes to weeks, depending on dose
10 - 15	Dry desquamation	2 - 3 weeks post-exposure, depending upon dose
15 - 20	Moist desquamation	2 - 3 weeks post-exposure, depending upon dose
25	Deep ulceration Radionecrosis	21 days

**Internal Contamination/Countermeasures:**

- Enters body through airways/ingestion/wound contamination and incorporation into body tissues
- Bioassay of Urine/Feces to assess internal contamination

**Treatment:**

**Potassium iodide:** blocks I<sup>131</sup> (nuclear detonation/reactor failure)

- Treat before exposure or within 6-12 hours of exposure
- Maintain until no longer being exposed
- I<sup>131</sup> Risk greatest to children, infants, and young adults

**Prussian Blue (Radiogardase®):** for Cesium – drives excretion via feces – U.S. FDA approved

- Dose: adults/children: 3 grams orally, 3 times a day/1 gram orally, 3 times a day - assess via bioassay

**DTPA:** U.S. FDA approved for Plutonium, Americium

- Every 24 hour Dosing
- Dose: Initially - 1 gm Ca-DTPA IV and then Zn form 1 gm IV until decision to cease by bioassay
- For inhalation intake use nebulizer (1:1 dilution with water/saline)

**U.S. FDA Potassium Iodide Guidelines**

Age Category	Predicted Absorbed Dose to the Thyroid cGy <sup>b</sup>	KI Dose (mg) <sup>c</sup>	Number of 130 mg Tablets
Adults 40 y	500	130	1
Adults 18-40 y	10	130	1
Pregnant or lactating women	5	130	1
Adolescents 12-18 y <sup>c</sup>	5	65	0.5
Children 3-12 y	5	65	0.5
1 month - 3 y	5	32	0.25
Birth - 1 month	5	16	0.125